Predictive policing management: a brief history of patrol automation

Article (Accepted Version)

PREDICTIVE POLICING MANAGEMENT: A BRIEF HISTORY OF PATROL AUTOMATION

Dean Wilson
Sociology
University of Sussex
Brighton, United Kingdom

Dean.wilson@sussex.ac.uk

Abstract
Predictive policing has attracted considerably scholarly attention. Extending the promise of being able to interdict crime prior to its commission, it seemingly promised forms of anticipatory policing that had previously existed only in the realms of science fiction. The aesthetic futurism that attended predictive policing did, however, obscure the important historical vectors from which it emerged. The adulation of technology as a tool for achieving efficiencies in policing was evident from the 1920s in the United States, reaching sustained momentum in the 1960s as the methods of Systems Analysis were applied to policing. Underpinning these efforts resided an imaginary of automated patrol facilitated by computerized command and control systems. The desire to automate police work has extended into the present, and is evident in an emergent platform policing – cloud-based technological architectures that increasingly enfold police work. Policing is consequently datafied, commodified and integrated into the circuits of contemporary digital capitalism.

Keywords: Police; Policing; Prediction; Economy; Automation

'Predictive Policing' is the latest buzz-term within policing circles. Heralded by *Time Magazine* in 2011 as one of the 50 greatest inventions of the year, predictive policing – emerging in the US shortly after the Financial Crash of 2008 – is now a global phenomenon rapidly being deployed in policing agencies.[1] Predictive policing may be defined as 'the application of analytical techniques—particularly quantitative techniques—to identify likely targets for police intervention and prevent crime or solve past crimes by making statistical predictions'.[2] The statistical predictions of predictive policing fall into two broad categories – predictions of places and predictions of persons, with the latter being the most controversial. The use of predictive analytics and machine learning has attracted enormous attention, linking predictive policing with digital innovations in automation rapidly advancing across numerous employment sectors. Interest in predictive policing to date has largely dwelt on the temporal novelty of its claim—that crimes can be predicted and interdicted *before* they occur. The opacity and quasi-mystical character assumed by the algorithms engaged has generated enthusiasm, scepticism and strident criticism. Technology vendors and some police view predictive policing as an invaluable aid to policing in an economic downturn, one that facilitates targeting of scarce resources while effectively dealing with crime. Critics suggest it will merely reinscribe and intensify patterns of racialised and militarized policing. Yet, despite the aesthetic futurism evident in media coverage and in technology trade literature – predictive policing is the culmination of longer-term historical vectors in the 'scientification' of police work that accelerated from the early twentieth century.[3]

Writing in 1967, Albert Reiss and David Bordua made the incisive comment that within police organisations 'every development in technology for police control of the population is accompanied by changes in the capacity of the organization to control its

members'.[4] Acknowledging the continued salience of this observation, this article seeks to examine through historical perspective what predictive policing represents in terms of the organisation, distribution and control of the police patrol function. My central argument is that there has been a persistent desire, particularly strident in the United States following the Second World War, to automate the police patrol function. Such desires have often been impeded by the autonomous nature of police patrol work, and the difficulty of quantifying the indeterminacies represented by the agential actions of individual officers. In the early twentieth century attempts to control and distribute patrol looked to the precepts of scientific management. From the 1960s much hope was vested in computerisation and the application of Systems Analysis to police patrol work. Underlying these efforts resided a series of puzzling questions that were straightforward in industrial sectors, but proved complex for police organizations: what was policing's product? How were police organisations to be made efficient, and how could this efficiency be measured? Predictive policing appears to be the solution for many of these problems.

Command, Control and Calculation

In early twentieth century America, progressive reformers began to view police agencies as antiquated and dysfunctional organisations unfit for the needs of a modern industrial society. One of the first motion picture representations of policing compounded this perspective. Mack Sennett's *Keystone Cops* were incompetent dullards, bewildered by modern technologies such as the telephone and automobile, and utterly ineffectual. As early as 1910 the International Association of Chiefs of Police decried early representations of police officers, who were, they claimed, 'sometimes made to appear ridiculous'. They went on to protest that young people attending motion-picture houses were given 'an improper idea of the policeman'.[5] Nevertheless, early research conducted into police departments appeared to suggest that Sennett's *Keystone Cops* were far closer to reality than the IACP cared to admit. Between 1915 and 1917 Raymond Fosdick undertook a comprehensive study of US police departments for the Rockefeller-funded Bureau of Social Hygiene, conducting investigations in seventy-two US cities. Published in 1920 as *American Police Systems* his findings were damning. Concluding his study, Fosdick commented that there was 'little to be proud of' and that American police systems were 'sordid and unworthy'. His study concluded that although Americans had been 'successful in the organization of business and commerce, pre-eminent in many lines of activity, we must confess failure in the elemental responsibility laid on all people's who call themselves civilized of preserving order in their communities'.[6]

As Fosdick's allusion to business and commerce suggest, the solution advocated was comprehensive modernisation of police structures through the application of modern business techniques, most specifically conceptions of scientific management. Arthur Woods, Police Commissioner of New York City between 1914-1918, suggested that police departments needed to restructure 'just as an army or a big business organisation is arranged, so as to meet and conquer all difficulties that arise'.[7] The imperative to restructure policing in line with modern notions of industrial efficiency was reinforced by further research projects that drew on the emerging academic field of 'public administration'. The National Institute of Public Administration in New York – founded in 1905 as the Bureau of City Betterment and until 1921 known as the Bureau of Municipal Affairs – conducted studies in seventeen US cities between 1913 and 1924.[8] The Institute – whose mission was defined as 'applying the test of fact to the analysis of municipal problems and the application of scientific method to governmental procedure' – was strongly shaped by F.W. Taylor's 1911 publication *Shop Management*.[9] The advice arising from the Institute's projects consistently advocated the application of modern business techniques to patrol supervision, scientific planning for police departments, the circulation of orders in written form to strengthen day-to-day supervision, and the rationalisation of police reporting and records.

A Police Chief from the Berkeley Police Department in California, August Vollmer, emerged as the principal interwar embodiment of the philosophy that came to be known as 'police professionalism'. Something of an autodidact, Vollmer enthusiastically embraced both technology and the principles of scientific management in the organisation of policing. The key elements of police professionalism fell into three broad categories: the centralization of authority, the rationalization of command and control and elevation of the quality of police personnel. This broad programme of reform was eagerly embraced by the IACP, who hoped it would raise policing to the status of a profession, akin to law and medicine.[10] While Vollmer developed innovations such as crime laboratories that projected images of policing as a scientific enterprise, the lynchpin of the police professionalisation project was the fusion of radio communications with automobility. For Vollmer the growing complexity of urban environments placed added burdens on police departments that could only be addressed through embracing the latest developments in science and technology. Patrol cars equipped with two-way radios became imbued with almost magical qualities, energizing a thread of 'techno-solutionism' that extends into the present.[11] Vollmer was tireless in his promotion of radio-equipped patrol cars, commenting that 'snaring criminals in a radio network woven by broadcasting to radio-equipped cars has become a matter of seconds' something which had 'synchronized the arrest with depredation'.[12] Vollmer effusively extolled the omnipotent police power enabled through automobility fused with radio communications, suggesting that:

> With advent of the radio equipped car a new era has come…Districts of many square miles…are now covered by the roving patrol car, fast, efficient, stealthy, having no regular beat to patrol, just as liable to be within 60 feet as 3 miles of the crook plying his trade–the very enigma of this specialized fellow who is coming to realize that a few moments may bring them down about him like a swarm of bees–this lightening swift "angel of death"[13]

Radio-equipped patrol cars were to become the main means of police patrol within several decades. While the radio-equipped patrol car altered relations between the police and the public, they also transformed the relationship between patrol officers and their supervisors. Two-way radios were introduced in 1929 meaning that cars could be alerted immediately of a call for assistance. But the patrol officer could also be checked on frequently and without notice. The potential for remote control of patrol officers enabled by two-way radio communications was seen as so significant that some believed city crime might be eliminated entirely.[14] Other commentators saw the potential for a continuous uninterrupted transmission that rendered the patrol officer amenable to command; regardless of their proximity to a patrol vehicle. In 1936 one Police Chief from Wyandotte, Michigan predicted the increased portability of radio communications, suggesting that 'the time will come when every individual policeman on the beat will be equipped with a small radio receiver and be directed by radio orders'. Small belt radios were already in use by 1940 in Atlantic City, although this development rolled out only slowly across other police departments.[15] The imaginary of an uninterrupted transmission of command and control was to reappear throughout the post-war years.

August Vollmer reflected approvingly on American policing's transformation in 1933, remarking that: 'the principles of military science, including those of strategy, tactics logistics, communications, and others, were adopted by the police and applied to the problem of reducing crime and protecting the community'.[16] While Vollmer explicitly cited military influences, the template for police reform was equally the structure of the modern corporation and its focus on results. This focus on the 'product' of policing fuelled a concurrent reconceptualization of policing. Earlier in his career, Vollmer had been optimistic that police departments could be agents of broader social transformation through attacking the root social and psychological causes of crime, as well as its surface manifestations. The patrol officer, he suggested, would be a 'practical criminologist' armed with the latest criminological

research and theories and able to intervene in people's lives before they entered a life of crime.[17] The difficulty of demonstrating results from such an undertaking, however, led to this broader concept of policing – largely linked to the historical social service role of police – to evaporate. William H. Parker, Chief of the Los Angeles Police Department in the 1950s and 60s, claimed that police could do little more than apply 'emergency treatment' to 'surface wounds'. Parker's view was that police 'could contain but not convert criminals, repress but not prevent crime'.[18] The defining of policing as exclusively concerned with crime control had the advantage of providing clear measures of police efficiency and productivity. The speed at which police responded to calls for service – along with statistical variations in crime rates as a result of police interventions – would provide a clear and calculable basis for assessing police work. It was intensifying the pace of police response that seized the imaginations of systems analysts in the 1960s, and which formed the basis for the progressive mathematization of policing.

Systems Analysis was developed by Edward Paxson at RAND Corporation in the late 1940s and was a development of Operations Research. It owed a debt to Herbert Simon's theories of administrative rationality, which extended mathematical formalization into the realm of business of social problems.[19] Simon – a polymath who straddled fields of philosophy, administrative science, computation and artificial intelligence – confidently predicted in his 1960 publication *The New Science of Management Decision* that 'technologically…machines will be capable, within twenty years, of doing any work that a man can do' going on to suggest that the routinisation of tasks inherent in automation would for many workers constitute 'a welcome refuge from the trackless forests of unfamiliar problem spaces'.[20] Operations Research had rested on the mission of calculating the most effective use of existing equipment. The objectives of Systems Analysis were, however, considerably more expansive. Systems Analysis presented a range of options based upon mathematical modelling but also incorporating a combination of concepts drawn from social psychology, economics, control theory and other social and behavioural sciences. As David Noble argues, by the early 1960s Systems Analysis had 'attained a force and an aura all its own'.[21]

The force of Systems Analysis was brought to bear on problems of policing in the *Task Force Report on Science and Technology* published in 1967 as part of the *President's Commission on Law Enforcement and the Administration of Justice*. The *Task Force Report* was prepared by the Institute of Defence Analysis (IDA), founded as a competitor to RAND Corporation, and able to pay higher salaries than government departments through its status as a Federally-Funded Research and Development Centre.[22] The IDA conducted research on nuclear war, ballistic missile programs and the feasibility of missile defence systems, and was contracted to oversee a special report on the application of science and technology to the criminal justice system. The *Task Force Report* was based on a reading of current technological developments and their potential application to policing. The valence towards economy was evident in the brief outline of systems analysis offered, which defined it as the 'use of mathematical models of real-life systems to achieve various ways of designing and using these systems to achieve specified objectives at minimum cost'.[23]

While the *Task Force Report* dwelt on a range of technological possibilities, including the development of digital fingerprinting and the use of helicopters, greatest attention was paid to the technological and mathematical development of police systems of communications, command and control. Applying the quantitative tools of Systems Analysis, the IDA reasoned it is was in the area of command and control where 'the potential for improvement is probably greater here than in any other aspect of police operations'.[24] The Report envisaged the use of computerised command and control centres that went well beyond merely 'automating existing procedures' but which would provide statistical calculations and projections based upon 'study and experiment' of how police responded to emergency situations, how patrol should be allocated by geography and time, optimum patrol tactics and even how to respond to riots. Underlying the report was the belief that 'in both military and police work, rapid and complete information gathering, decision-making, and

dissemination are of crucial importance' going on to note that police response time 'can often be reduced by speeding up the command and control function'.[25]

The *Task Force Report* – and its dedication to accelerating command and control – gave rise to a specific research field of police patrol analysis, that sought to apply mathematical models to patrol dispatch and distribution. The earliest use of computers in policing was in patrol allocation, and in the early 1960s IBM had developed the Law Enforcement Manpower Resource Allocation System (LEMRAS) engaged by the Saint Louis Police Department.[26] Further models were developed in through the 1960s and 1970s. Richard Larson – an electrical engineer from MIT – was a researcher on the *Task Force Report* and sought to apply queuing theory to problems of patrol deployment. Queuing theory had been developed in the early twentieth century and had grown increasingly sophisticated over the course of the Second World War.[27] Larson's 'hypercube model' was developed into a book length study, and also included simulations that allowed police managers to experiment with how different forms of police deployment – primarily the adding or subtracting of officers – would impact upon response times. Those working on police patrol analysis calculations became frustrated by the randomness and incalculability of police activity between calls for service.[28] In an executive summary of the Patrol Car Allocation Model (PCAM), developed by RAND Corporation's New York Office, Chaiken and Dupont identified the major impediment to more precise modelling as posed by 'meals, self-initiated anticrime activities, maintenance or repair for the vehicle, special assignments by a superior officer, and authorised or unauthorised personal activities'. These, they suggested, accounted for between 35 percent and 60 percent of police time and it was imperative they were rendered calculable for optimal functioning of the model.[29]

The Systems Analysis approach sought the rapid dissemination of information, but also expanded collection of data on police operations – which it was reasoned would facilitate evermore precise accuracy in the mathematical models. One means of achieving this was through some form of remote vehicle monitoring that would track police operations in real-time. Prefiguring the widespread incorporation of computer terminals within police vehicles, the *Report* pointed to a range of potential developments that potentially facilitated police in the field being continuously monitored and analysed. The miniaturization of radio equipment was advocated so that officers could be contacted and monitored even when away from their vehicles. 'Teleprinters' in vehicles were imagined, through which information could be rapidly exchanged from the street to the command center, and vice versa. Particular interest was expressed in the capacity to monitor and map patrol car movements in real time – primarily to assist in automated patrol allocation – with suggestions for sensor and transponder networks to allow the tracking of patrol cars in transit. What was termed Automatic Vehicle Monitoring (AVM) was to emerge as a policing innovation always just about to happen. Police reporter turned ethnographer Jonathan Rubinstein noted in his 1973 study of Philadelphia Police that engineers were 'developing radar-operated car-locator systems, which will show on an electrified map the exact location of each patrol car'.[30] The 20 million dollar Los Angeles Police Department Electronic Command and Control System – developed in the 1960s and located in a bomb-proof bunker – was initially to have included a computerized mapping system that would monitor every patrol car on a live display grid, but this was abandoned due to cost.[31] The integration of GPS data in many predictive policing software programs brings this long held aspiration to fruition.

The mathematization of command and control represented a significant development in the automation of policing, although the impact of such automation was overwhelmingly discussed in positive terms of effectiveness and efficiency. How patrol officers experienced such technological systems was regarded as largely unproblematic. One notable exception to this was the Marxist police scholar Sid Harring. In 1981 Harring published a short article entitled 'Taylorization of Police Work: Prospects for the 1980s' in which he directly linked police computerization to the processes of labour force deskilling outlined by Harry Braverman in *Labour and Monopoly Capital*.[32] The fiscal crisis emerging out of the 1973 Oil Crisis had focused new attention on the management of police work,

with a raft of studies appearing that examined – and proposed models for improving – productivity in policing. A key work in the field was Joan Wolfe and John Heaphy's 1975 *Readings on Productivity in Policing*, published by the Police Foundation, which was followed by a wave of publications financed by the Federal Government Law Enforcement Assistance Administration (LEAA) including *Police Productivity* (1978), *Police Management* (1978) and *Police Manpower Management* (1980). Investment in information technology – combined with ever more elaborate models of personnel management – were viewed as possible means by which the elusive concept of police productivity might be achieved.

Kent Colton, a Professor at the MIT Department of Urban Studies and Planning, evaluated the San Diego Computer Aided Dispatch in the late 1970s. His evaluation suggested the most significant barriers to technology adoption in police agencies were human, reporting that 'the greatest problems which surfaced were still the "people questions" of morale and motivation'.[33] The primary human problem was that of boredom, with Colton noting that 'the system was so highly automated that a member of staff became bored because the machine controls had taken over many duties'. The San Diego CAD system had, he conceded, 'destroyed the personal touch'.[34] While research into computer systems within police departments continued, analysis of the potential of computerization to induce worker alienation was most frequently ascribed to resistance to change or to the amorphous 'people question' indicated by Colton. Nevertheless, in detailed ethnographic work conducted by Ericson and Haggerty in the early 1990s, there were some revealing findings. At the time of their fieldwork, the in-car 'teleprinters' envisaged in the IDA study had become a reality with the diffusion of in-car computer terminals for transmitting information between officers in the field and control centres. They noted a 'pervasive concern among police officers about the dehumanizing effects of some of the communication technologies being used' going on to report that the CAD terminals in patrol cars – and their screen formats – 'were seen as too mechanical, to the point where patrol officers were made to feel that they themselves were little more than machines'.[35]

Flexible Business-Like Policing

Two inter-related philosophies of policing bear a direct lineage to predictive policing: problem-oriented policing and COMPSTAT. Both emerged from sustained criticism of the professional model of policing as expounded by police reformers such as August Vollmer and O.W. Wilson—quantitatively enshrined in the mathematical models of police patrol analysis. Despite ever greater efficiency in terms of dispatch and response, crime rates – the standard measure of police success or failure – continued to rise. Virulent criticism was levelled at the perceived process efficiency fetishism evident in the fixation on response times, with the suggestion that policing agencies were ossified unresponsive bureaucracies fixated with means at the expense of ends. The situation was succinctly summarised by University of Wisconsin-Madison Law Professor Herman Goldstein, who suggested that police agencies had 'reached a plateau at which the highest objective to which they can aspire is administrative competence'. Elaborating his critique with analogy, Goldstein went on to note that; 'the situation is rather like that of a private industry that studies the speed of its assembly line, the productivity of its employees, and the nature of its public relations program, but does not examine the quality of its product'.[36]

The central tenets of problem-oriented policing were outlined by Goldstein in a 1979 article, and later elaborated in a book length study. Goldstein defined several factors that were compelling a reconceptualization of policing, including the fiscal crisis in US cities, which meant that police were under duress to provide demonstrable outcomes that resulted from their budgets, an increasing consumer mentality amongst the public in relation to police services, and the necessity – as Goldstein perceived – to side step rank and file resistance from police unions that had followed other efforts at substantive structural change within police bureaucracies. In reconceptualising the police mission, Goldstein revisited the contested question of what actually constituted the 'product' of policing. He

argued that the police dealt with a range of behavioural and social problems, and that their product, consequently, was to find solutions to those problems. The police were professional problem solvers.

The precepts of problem-oriented policing reinvented the police officer as an entrepreneur responsible for the research, design and delivery of public safety products. What became known simply by the acronym POP, stressed the research and evaluation of local problems in their specificity, and a commitment to collaborative problem-solving that involved diverse agencies and actors drawn from business, government and communities. Collaborative crime control projects were to be attended with careful evaluation – mostly quantitative – to form banks of case studies that would then inform 'best practice'. Rather than random patrolling to identify offenders, Goldstein envisaged policing as a series of flexible collaborative research-based projects. In devising the solutions to problems that constituted their product, officers were also encouraged to explore novel alternatives not restricted to law and regulation. Structurally, POP aimed to free officers from the strictures of hierarchical top-down command and control techniques of the professional policing model. Mirroring emerging management discourses, POP envisaged policing agencies as lithe open networks, responsive to change and engaged in a continuous process of research, innovation and evaluation driving towards continuous improvement.[37] The mimicry of business models was more than just analogous; it was often a direct transplantation. From the 1970s police agencies aspiring to overturn the perceived evils of the professional model opened their doors to a flood of consultants from the private sector. External consultants imparted the latest wisdom from the world of business; which was then operationalised within police organizations.[38] Importantly POP also advanced the notion of data-driven agencies – data that in its contingent and specific conception of 'problems' extended well beyond the traditional in-house sources of police and crime statistics.

The decentralised organisational vision of POP was to some extent absorbed within COMPSTAT – a system initiated in New York City in the 1990s, and heavily reliant on computerization, crime mapping and statistics. The term COMPSTAT is often taken to be an abbreviation of computer statistics, however Vincent Henry (a former NYPD detective) maintains it was simply the name of the computer directory where the original programmer stored the data processed by the system.[39] The significance of COMPSTAT to the development of predictive policing rests in evident ways in the fusion of statistical data with police work, but additionally through the close association of William J. Bratton with the programme. Bratton remains the most high-profile figure in American policing, and after serving in the Marine Police Corps during the Vietnam War, became a sworn officer in the Boston Police Department in 1970, going on to lead three of the largest police departments in the United States; Boston, New York and Los Angeles.[40] Discussion and analysis of COMPSTAT has frequently been overshadowed by Bratton's fervent and concurrent advocacy in the 1990s of the police strategy that accompanied it: 'broken windows' policing. The term 'broken windows' was drawn from a short article published in the *Atlantic Monthly* in 1982 by George Kelling and James Q. Wilson, whose essential argument was that aggressive policing of minor incivilities in neighbourhoods would lead to a reduction of more serious offences, and consequently to an overall reduction in crime rates.[41] When statistical declines in crime in New York City did occur during Bratton's tenure, heated debate erupted within criminology which critiqued the statistical validity of the claims (crime declines had occurred in many other US cities without broken windows policing) and pointed to the deleterious impact of aggressive police tactics within communities.[42]

While important, an exclusive focus on the broken windows strategy – with which COMPSTAT was neither initially nor intrinsically linked – has tended to deflect attention from the fact that COMPSTAT was first and foremost a police management paradigm.[43] The most visible aspect of COMPSTAT management in practice – realistically portrayed in US police drama *The Wire* – resided in twice-weekly strategy meetings, where precinct commanders appeared before senior police administration to report on their area statistics; and to explain what strategies they had put in place to deal with them. COMPSTAT meetings were held in a 'data-saturated environment' where statistics and other

information were projected onto screens, with commanders required to respond to questions from senior police management, other precinct commanders and at times members of the public and the media. COMPSTAT differed from POP however in that responsibility was devolved – not to frontline officers – but firmly to middle management who in US police agencies were generally precinct commanders. While commanders were given greater latitude in terms of setting priorities and allocating resources, many found COMPSTAT intensified work hours and stress – as one officer commented to researchers 'a precinct commander has no life [outside Compstat]'.[44] Supposedly COMPSTAT management aimed at an equilibrium between punishment and reward. Nevertheless, as it operated the balance tilted strongly towards punishment.

The data-driven nature of COMPSTAT accelerated the collection and processing of data – with precinct commanders having access to crime analyses for the previous week, rather than three or six-month old data in earlier computer analysis. Crime mapping also underwent rapid diffusion with the take-up of COMPSTAT inspired programs by US police forces. Crime mapping was used to analyse how crime and patrol were clustered geographically, and also for 'hour of the day' and 'crime spike' analysis. Consistent with the precepts of POP, other data-sets were also integrated: workload data, population demographics and municipal government data[45]. COMPSTAT was heavily data-driven, placing emphasis not only on timely statistical data but also upon its visualization through crime mapping. Consequently, the enthusiastic take-up of COMPSTAT within US police agencies also signalled the integration of computerization into routine patrol work on an unprecedented scale – a trend abetted by the development of Client Server Technology in the 1980s and the development of personal computers with sufficient processing power for increasingly complex mapping and statistical programs. Moreover, while Goldstein's vision of POP had suggested police officers actively mobilizing their local knowledge to arrive at solutions, under COMPSTAT 'solutions' were often generated by increasingly sophisticated software programs. Although still heavily reliant on human crime analysts, the machine was progressively providing both an analysis of the problem and the solution to it.

While the term 'predictive policing' invites comparison to the speculative calculations that infused security organizations after 9/11, it also builds upon less dramatic developments in criminological research.[46] The immediate technical precursors of predictive policing were more prosaic exercises in quantitative criminology, aimed at crime reduction and the efficient deployment of police resources. The first was 'hot spot' analysis, that seeks to identify high crime locations (usually limited in size to locations that can be viewed in their entirety by the human eye at street-level). Hot spot analysis has primarily been used to allocate police patrol to specific locations, often engaging the 'Koper Curve', which, based upon analysis of 110 hot spots in Minneapolis, suggested that ten to fifteen minutes was the optimal time for a patrol to remain at a location to achieve 'residual deterrence' (the length of time until crime reappears at the location).[47] By the late 1990s quantitative criminologists were suggesting that more sophisticated computer analyses could be undertaken to identify 'early indicators' of future hot spot locations, thereby energizing more proactive patrol. These efforts received a substantial boost in the late 1990s, when the National Institute of Justice funded five predictive modelling research projects, that engaged diverse methodologies from fields such as artificial neural network mapping, spatial econometrics and epidemiology.[48] A further impetus was the development of criminological research into 'near repeat' patterns of crime - first calculated using statistics of house burglary processed through an algorithm developed within epidemiological research in the 1960s - suggesting the probabilities of further crimes increased not only for specific street addresses, but also for those in surrounding areas. As Benbouzid notes in a detailed analysis of the evolution of near-repeat criminological research, the software mapping program that emerged from it (PROMAP, an abbreviation of Prospective Crime Mapping) aimed to move beyond simple linear models through which past patterns would be replicated, towards increasingly complex spatio-temporal modelling of future crimes engaging notions of contagion.[49]

The privileging of statistical data and analysis in COMPSTAT was amplified and reinforced by a surge of interest after 9/11 in another policing strategy termed Intelligence-Led Policing (ILP). ILP emerged in the 1990s, initially from attempts by Kent Police in the UK to disrupt local crime networks.[50] ILP emphasized targeted police interventions based upon extensive data collection from covert informants, offender interviews, recorded crime and calls for service, surveillance of suspects and miscellaneous community sources. Akin to COMPSTAT, ILP envisaged 'business-like' and data-driven policing that was proactive rather than reactive, and which encouraged flexible team-based structures and collaborative information sharing beyond internal 'silos' and bringing in external partners both public and private. Nevertheless, ILP did not embrace as POP had done the concept of the individual officer as public safety entrepreneur. ILP revived earlier professional models of top-down control, where analysis and intelligence flowed up to the executive level, who would set targets and priorities to be enacted on the frontline.

By the mid-2000s ILP had evolved into a broader philosophy that used data-driven decision making and strategic problem-solving not only for crime control but also for police management and resource allocation.[51] The inclusion and collation of disparate sources of data advanced by ILP dovetailed seamlessly with the US post-9/11security zeitgeist. In the 1990s, Ericson and Haggerty had already noted that computerization – and the ease of data collection and retrieval it facilitated – stimulated data fetishism through police hoarding of 'just-in-case knowledge about crime and criminals'.[52] The 9/11 Report's conclusion that there had been a failure to 'connect the dots' energized this tendency, which spread across security domains. As Mark Andrejevic has suggested 'the appetite of the database … is, for the foreseeable future, insatiable'.[53] The wisdom of expansive data collection was exemplified in what was to become the foundational morality tale of predictive policing: the story of Walmart, the hurricane and strawberry Pop Tarts. Using data mining and predictive analytics to scour their databases, Walmart was able to adjust its supply chain in anticipation of hurricane conditions. Predictive analytics dictated that the products most in demand during hurricane conditions were bottled water, ducted tape and strawberry Pop Tarts. There were two key lessons advanced from the tale of Walmart and strawberry Pop Tarts. The first was that, through data mining and predictive analytics, policing agencies could become flexible, responsive and anticipatory. The second lesson was that – despite the logic of bottled water and ducted tape – it was not obvious why consumers facing a hurricane would want to buy Pop Tarts – in particular strawberry ones. The moral of the story was that it wasn't necessary to know. What mattered was the statistical fact that they did buy them.[54]

By the time PredPol™ launched the first commercially available predictive policing software in 2011 the concept had been widely discussed, and in some policing areas already implemented. Predictive policing was, in this sense, born fully formed – a medley of contemporary policing methodologies and philosophies. As one Police Chief from Nebraska who attended an NIJ predictive policing symposium in 2010 astutely remarked, predictive policing was nothing new. It was, rather, a melange of strategies and tactics already familiar; 'predictive policing' had just simply brought them 'under the one umbrella'. He did, nevertheless, comment that one notable difference was 'the tremendous infusion of data'.[55] Consequently, the diffusion of predictive policing software, and the number of vendors, has rapidly expanded. Animated public and academic discussion of predictive policing needs to remain cognisant of the way that 'predictive policing' has become shorthand for describing a more extensive process of digitalisation unfolding within policing agencies. Predictive policing software is often simply one component part of larger modular technological systems that incorporate disparate technologies from body worn cameras and sub-lethal weapons through to public and private area surveillance systems and digitized police databases. Policing agencies are also being implored to head to the Cloud, with technology corporations such as Microsoft offering specific 'Public Safety and Justice' cloud-based platforms that extend from policing to parole, and are envisaged as an essential component of the digital infrastructure of Smart Cities.[56] Policing thus represents a sizeable target market for platform capitalism, with the 'Public Safety and Justice' market segment worth US$247.5

billion in 2016 and estimated to reach US$456.56 billion by 2021.[57] Predictive policing is now platform policing.

What was less clear with the initial flurry of interest in predictive policing was the impact it would have on agencies internally, in terms of the management and control of frontline officers. One evaluation study – led by co-founder of PredPol™ mathematician Geoff Mohler – extolled the virtues of integrating GPS tracking to provide greater analytical precision, but also to 'provide information on officer activity when not on a predictive policing mission'.[58] Some indication of the management imaginary contained within predictive policing was provided in an article co-written by COMPSTAT founder Bratton with Sean Malinowski, then Assistant Commander of the LAPD Real-Time Analysis and Critical Response Centre, and later a key figure in LAPD's adoption of PredPol™. In 2002 Bratton became Los Angeles Police Department (LAPD) Chief of Police, where he continued to develop the managerial aspects of the COMPSTAT model into what he dubbed COMPSTAT Plus. In developing COMPSTAT as a managerial tool, Bratton and Malinowski looked directly to major retailers – in particular Target Corporation – who were able to monitor employees performance 'in real time according to a series of integrated performance metrics that measure and then display weighted data'. As with POP and ILP, the authors viewed the police organisation as an increasingly porous and collaborative enterprise venture, with the future viewed as an opportunity to 'expand our partnerships with our academic and business communities to continually improve our ability to forecast crime'.[59] In this vision, the desire for efficiency evident in the 1960s application of Systems Analysis reached its zenith in an imaginary of totally instantaneous transmission and control. As Bratton and Malinowski articulate this vision:

> Soon we will see LAPD officers receiving information in relation to their position in time and space via Global Positioning Satellite technology and then acting on and reporting their actions as they are happening for immediate inclusion in the data set. By streamlining data entry and automating it, and then developing a more robust capability to data mine, we will move closer and closer to real time.[60]

With a keen interest not only in crime control, but also in intensive monitoring and control of those charged with producing it, the authors suggest partnering with 'businesses at the forefront of performance management' to share methodologies. Bratton and Malinowski advocate the collection of a wide-range of digitised data on police personnel; including metrics of overtime control, sick and injured on duty time usage, morale, community satisfaction, misconduct, excessive force, officer safety and employee wellness. Moreover, the POP concept of the patrol officer as entrepreneur and innovator is eclipsed by a vision of the patrol officer as delivery driver of public safety solutions – solutions calculated in advance and merely awaiting enactment. Glancing to the future, they suggest that: 'Computer technology will also likely be used to not only identify issues earlier, but to recommend interventions based on artificial intelligence support programs and functions that are self-healing and self-correcting'.[61]

The adaptation of business models in predictive policing is frequently explicit. Craig Uchida, a researcher from Justice and Security, Inc., remarked at the first predictive policing symposium in Los Angeles in 2009 that an intrinsic aspect of predictive policing was 'connecting corporate ideas and methods to policing'.[62] Nevertheless, in the comprehensive datafication and monitoring of the individual officer, there are evident affinities with contemporary military conceptions of the soldier on the electronic battlefield extending from the precepts of the Revolution in Military Affairs (RMA). The notion of 'network-centric warfare'– which extends from the principles of RMA – absorbs notions of flexibility, speed and complexity into military infrastructures, and draws upon concepts from economic and business management that imagine rapid interactions between informational nodes. 'Value' is then generated via the integrity and tempo of data pulsing between nodes of the network. The nearer information inclines towards complete precision, relevance and instantaneous

transmission and reception, the closer to full-spectrum superiority the military network proceeds.[63] Contemporary corporate imaginaries envisage this model transposed onto the policing context, as a continuous and instantaneous transmission enfolds the body of the patrol officer. Motorola Solutions, for example, has developed a sensorised patrol uniform that integrates display smart glasses, biometric health monitoring, gun holster sensors and environmental sensors. This 'future-ready' system – the brochure suggests – 'empowers police officers to respond and change the trajectory of a single moment while still in that moment'.[64]

The vision of integrated cloud security 'solutions' for policing perpetually reiterates the future of policing as a continuous process of real-time data exchange and analysis. This vision was forcefully expounded in TASER International's 2017 *Law Enforcement Technology Report*. Daniel Zehdner – former manager of the Las Vegas Police Department Body-Worn Camera Program – provided the following scenario for the TASER report to promote the advantage of cloud-based security paired with real time analytics:

> I could potentially walk down the street with a camera in real-time, scanning faces, doing facial recognition while it's recording, sending that data to the cloud for real-time analysis, have that data come back and somebody tell me, "That guy in the red hat, red shoes you just passed, he's wanted for burglary". That type of real-time, big data analysis application would be huge.[65]

Progressively the informational carapace surrounding patrol officers replicates a synthetic real-time most frequently associated with online contexts. As Adrian Mackenzie argues, this is a conception of real-time which attempts to 'collapse the intervals between event and its reception, so that the event is structured by its processing'.[66]

While such a scenario is likely to excite some police managers – and prove equally horrifying for their critics – these future scenarios elide the issue of how such systems also increasingly gesture towards the automation of police decision-making through continuous data flows that fold back upon themselves. This possibility is also canvassed in the TASER report, which includes an interview with Dr George Poste. Poste suggests that 'many elements of decision support software are now eclipsing in a superior way, the judgement of highly skilled professionals, simply because the scale and multidimensionality of the data sets quickly eclipses the cognitive capacity of humans'.[67] The potential of automated decision-making – facilitated by the datafication of all police interactions – is also echoed by Patrick Perrot from the French Ministry of Interior. Perrot suggests that the missing element in automated police decision-making is 'the intention of the police officer'. Nevertheless, he goes on to suggest that 'we cannot exclude for the future that the extension of AI in this field is based on an analysis of police officer patterns'.[68] Herbert Simon argued in 1960 that in some fields human workers would continue to enjoy comparative advantage, including 'some kinds of nonprogrammed problem solving, and some kinds of service activities where face-to-face human interaction is of the essence'.[69] Policing can be viewed as having both these characteristics. Simon was, however, judging this from a purely economic perspective. Recent advances in predictive policing – that pledge economy through datafication, and increasingly see software programs fused into larger technological ensembles – aspire to a vision initiated by the Systems Analysts in the 1960s. Efficiency and economy in policing are argued to be best achieved through datafication – and it is through datafication that police patrol is being progressively automated.

New cloud-based policing platforms project an imaginary of just-ahead-of-time law enforcement that anticipates and neutralizes crime and disorder before, or at the instant of, materialization. Once decried for being hierarchical and rigid, police agencies are reenvisaged as fluid networks; rapidly adaptable, continuously evolving and in a state of perpetual experiment. Moreover, datafication prises open police agencies for the value-seeking mechanisms of the digital economy.[70] Policing is

increasingly interpellated by technology enterprises not only through direct contracts, but through the informatization and commodification of police knowledge. The nearer police data flows edge towards instantaneity, the higher the potential value generated. The datafication of police work is also advanced as an ultra-solution to the manifold problems that beset contemporary US policing, ranging from stretched budgets to police brutality and violence. Senior policing figures celebrate the potential for finely targeted resources, improved knowledge of communities and intensified workforce control that attend extensive datafication; evident in the recently coined concept of 'precision policing'.[71] Others see the potential for enhanced police accountability, calling for transparency through access to the extensive data trails now emitted from the body of the officer.[72] At present the outcomes of digital police automation are uncertain. What is clear, however, is that policing – which had historically mirrored business models but struggled with how its 'value' could be measured – is becoming ever more integrated into the circuits of platform capitalism[73] – both as a consumer and a producer of value.

---

[1] For an overview of predictive policing and its current directions see Wilson, Dean (2018) 'Algorithmic Patrol: The Futures of Predictive Policing' in Završnik, Aleš (ed.) *Big Data, Crime and Social Control*, Routledge: London, 108-127; for a study beyond the US context, see Egbert's recent analysis of the *PreCobs* program; Egbert, Simon (2018) 'About Discursive Storylines and Techno-Fixes: The Political Framing of the Implementation of Predictive Policing in Germany' *European Journal of Security Research*

[2] Perry, W, McInnes, B, Price, C, Smith, S & Hollywood, J (2013) *Predictive Policing: The Role of Crime Forecasting in Law Enforcement*, Santa Monica, CA: RAND Corporation. xiii

[3] Ericson, Richard V. and Shearing, Clifford D. (1986) 'The Scientification of Police Work' in Böhm, Gernot & Stehr, Nico (eds) *The Knowledge Society: The Growing Impact of Scientific Knowledge on Social Relations*, D. Reidel: Dordrecht, pp. 129-159.

[4] Reiss, Albert J. Jr. and Bordua, David J. (1967) 'Environment and Organization: A Perspective on the Police' in Bordua, David J. (ed) *The Police: Six Sociological Essays*, John Wiley & Sons: New York, 49

[5] Cited in Reiner, Robert (2008) 'Police and the Media' in Newburn, Tim (ed) *Handbook of Policing*, 2nd edition, London: Routledge, p. 319

[6] Fosdick, Raymond B. (1920/1969) *American Police Systems*, Patterson Smith: Montclair, NJ, pp. 382-383; For a brief biography of Fosdick see *New York Times* (1972) 'Raymond B. Fosdick dies at 89', July 19.

[7] Walker, Samuel (1977), p.

[8] For a brief history of the IPA see Baruch College, CUNYhttps://www.baruch.cuny.edu/library/documents/IPA_Finding_Aid.pdf

[9] Walker, Samuel (1977) *A Critical History of Police Reform: The Emergence of Professionalism*, Lexington, Mass; Lexington Books.

[10] Walker, pp. 56-57.

[11] On techno-solutionism generally see Morozov, Evgeny (2013) *Click Here to Save Everything: The Folly of Technological Solutionism*, New York: Public Affairs.

[12] Vollmer, August (1931) National Commission on Law Observance and Enforcement (Wickersham Commission), Report No. 14, *The Police*, Washington D.C., U.S. Government Printing Office, p. 97.

[13] Vollmer (1931), p. 97.

[14] Rubinstein, Jonathan (1973) *City Police*, Farrar, Strauss & Giroux: New York, 20-21.

[15] Poli, Joseph (1942) 'The Development and Present Trend in Police Radio Communications', *Journal of Criminal Law and Criminology*, 33/2, p. 195.

[16] Vollmer, August (1933) 'Police Progress in the Past Twenty-Five Years' *Journal of Criminal Law and Criminology*, 24(1): 165.

[17] Walker, p. 73 & p. 81.

[18] Fogelson, Robert M. (1977) *Big-City Police*, Harvard University Press, Cambridge, Mass., p. 187.

[19] Edwards, Paul (1996) *The Closed World: Computers and the Politics of Discourse in Cold War America*, MIT Press, Cambridge, Mass. 114.

[20] Simon, Herbert A. (1960) *The New Science of Management Decision*, Harper & Brothers, New York, pp. 38-39.

[21] Noble, David (2011) *Forces of Production: A Social History of Industrial Automation* (with a new preface by the author), Transaction: Brunswick, NJ, p. 54
[22] Ceruzzi, Paul (2008) *Internet Alley: High Technology in Tyson's Corner, 1945-2000*, MIT Press, Cambridge, Mass., pp. 34-36.
[23] Institute of Defence Analysis (1967) *Task Force Report: Science and Technology*, US Government Printing Office: Washington, DC, p. 3.
[24] IDA, 21.
[25] IDA, 24-25.
[26] Raub (1995) p. 417.
[27] Ceruzzi, Paul (2008), p. 25.
[28] Larson, Richard C. (1972) *Urban Police Patrol Analysis*, MIT Press, Cambridge, Mass
[29] Chaiken, Jan M. and Dormont, Peter (1975) *Patrol Car Allocation Model: Executive Summary*, New York: New York City Rand Institute, p. 11.
[30] Rubinstein, Jonathan (1973) *City Police*, Farrar, Strauss & Giroux: New York, 21.
[31] Harring, Sid (1981) 28
[32] Harring, Sid (1981) 'Taylorization of Police Work: Prospects for the 1980s' *Insurgent Sociologist*, 10: 25-32.
[33] Colton, Kent (1980) 'Police and Computer Technology: The Case of the San Diego Computer-aided Dispatch System', *Public Productivity Review*, 4/1: 40-41.
[34] Colton, Kent (1980), 40-41.
[35] Ericson, Richard V. and Haggerty, Kevin D. (1997) *Policing the Risk Society*, Toronto: University of Toronto Press, pp. 415-416.
[36] Goldstein, Herman (1979) 'Improving Policing: A Problem-Oriented Approach' *Crime and Delinquency*, 25: 236-258.
[37] Cf. Boltanski, Luc and Chiapello, Evé (2007) *The New Spirit of Capitalism*, translation by Gregory Elliott, Verso: London, Chapter 1.
[38] Weisburd, David, Mastrofski, Stephen D., McNally, Anne, Greenspan, Roseanne & Willis, James (2003) 'Reforming to Preserve: Compstat and Strategic Problem Solving in American Policing' *Criminology*, 2/3: 426-427.
[39] Henry, Vincent (2009) 'CompStat' in Wakefield, Alison and Fleming, Jenny (eds.) *The Sage Dictionary of Policing*, Sage: London
[40] Bratton's career until the 1990s, and the development of his conceptions of policing, are detailed in his autobiography Bratton, William, J. with Knobler, Peter (1998) *Turnaround: How America's Top Cop Reversed the Crime Epidemic*, Random House: New York.
[41] Wilson, James Q. and Kelling, George (1982 March) 'Broken Windows: The police and neighbourhood safety' *Atlantic Monthly*.
[42] For a critical account see Harcourt, Bernard (2001) *Illusion of Order: The False Promise of Broken Windows Policing*, Harvard University Press.
[43] Eterno, John A. and Silverman, Eli B. (2005) 'The New York Police Department's Compstat: dream or nightmare?' *International Journal of Police Science & Management*, 8/3; 218-231.
[44] Weisburd, David, Mastrofski, Stephen D., McNally, Anne, Greenspan, Roseanne & Willis, James (2003) 'Reforming to Preserve: Compstat and Strategic Problem Solving in American Policing' *Criminology*, 2/3: 449.
[45] Weisburd, David, Mastrofski, Stephen D., McNally, Anne, Greenspan, Roseanne & Willis, James (2003) 'Reforming to Preserve: Compstat and Strategic Problem Solving in American Policing' *Criminology*, 2/3: 426-427.
[46] For discussion of pre-emption in the justice system see McCulloch, Jude and Wilson, Dean (2016*) Pre-Crime: Pre-emption, precaution and the future*, Routledge: London; in security more generally see Amoore, Louise (2013) *The Politics of Possibility: Risk and Security beyond Probability*, Duke University Press, Durham NC.
[47] Sherman, Lawrence (2009) 'Hot Spots' in Wakefield, Alison and Fleming, Jenny (eds.) *The Sage Dictionary of Policing*, Sage: London, pp 157-160.
[48] La Vigne, N. & Groff, E. (2001) 'The Evolution of Crime Mapping in the United States: From the descriptive to the analytic' in A. Hirschfield & K. Bowers (eds.) *Mapping and Analysing Crime Data: Lessons from research and practice.* London: Taylor & Francis, pp. 203-221.
[49] Benbouzid, Bilel (2015) 'From Situational Crime Prevention to Predictive Policing: Sociology of an Ignored Controversy' *Champ Penal/Penal Field*, Vol. X11. https://journals.openedition.org/champpenal/9066
[50] Tilley, Nick (2008) 'Intelligence-Led Policing' in T. Newburn & P. Neyroud (eds.) *Dictionary of Policing*, Cullompton: Willan: 146-148.
[51] Ratcliffe, Jerry H. (2009) 'Intelligence-Led Policing' in Wakefield, Alison and Fleming, Jenny (eds.) *The Sage Dictionary of Policing*, Sage: London, pp 177-179; for an extended treatment see Ratcliffe, Jerry H. (2016) *Intelligence-Led Policing*, 2nd Edition, Routledge: London.
[52] Ericson and Haggerty (1997) p. 438.
[53] Andrejevic, Mark (2013) *Infoglut: How too much information is changing the way we think and know*. London Routledge, p. 78.
[54] Beck, C & McCue, C 2009, "Predictive Policing: What Can We Learn from Wal-Mart and Amazon about Fighting Crime in a Recession?, *The Police Chief*, 76(11) www.policechiefmagazine.org

[55] Pearsall, B 2010, 'Predictive Policing: The Future of Law Enforcement?', *NIJ Journal*, 266, p. 8
[56] Microsoft Enterprise (2017) 'On Demand: Public Safety Agencies Modernize to Improve Situational Awareness' https://enterprise.microsoft.com/en-us/event/public-safety-agencies-modernize-improve-situational-awareness/; For a perceptive analysis of 'cloud security' see Amoore, Louise (2018) 'Cloud geographies: Computing, data, sovereignty', *Progress in Human Geography*, 42(1): 4-24.
[57] Oracle® (2017) 'Integrated Policing Platform' Oracle Data Sheet, p. 1; on 'platform capitalism' see Srnicek, Nick (2017) *Platform Capitalism*, Cambridge: Polity.
[58] Mohler, G., Short, M., Malinowski, S., Johnson, M., Tita, G., Bertozzi, A. and Brantingham, P. (2015) 'Randomized Controlled Field Trials of Predictive Policing', *Journal of the American Statistical Association*, 110 (512): 1399-1411.
[59] Bratton, William J. and Malinowski, Sean W. (2008) 'Police Performance Management in Practice: Taking COMPSTAT to the next level', *Policing*, 2/3: 264.
[60] Bratton, William J. and Malinowski, Sean W. (2008), 265.
[61] Bratton and Malinowski (2008), 265.
[62] Uchida, Craig D. (2010) 'A National Discussion on Predictive Policing: Defining Our Terms and Mapping Successful Implementation Strategies' *National Institute of Justice Discussion Paper*, Department of Justice: Washington DC., p. 2.
[63] Bousquet, Antoine (2009) *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* London: Hurst & Company, p. 220.
[64] Motorola Solutions (2015) *Communication Systems Stop Crime in Its Tracks: Real Time Intelligence Takes Police Beyond Responding, To Prediction and Prevention*, Motorola Solutions, Schaumburg, Ill., p. 7.
[65] TASER International, Inc. (2017) *2017 Law Enforcement Technology Report*, TASER International, p. 10.
[66] Mackenzie, Adrian (2002) *Transductions: Bodies and Machines at Speed* London: Continuum, p. 168.
[67] TASER International, Inc. (2017) *2017 Law Enforcement Technology Report*, TASER International, p. 10.
[68] Perrot, Patrick (2017) 'What about AI in criminal intelligence? From predictive policing to AI perspectives', *European Police Science and Research Bulletin*, 16, p. 74.
[69] Simon, Herbert A. (1960) *The New Science of Management Decision*, Harper & Brothers, New York, p. 38.
[70] Gates, Kelly (2019) 'Policing as Digital Platfrom' *Surveillance & Society*, 17(1/2): 63-68.
[71] Bratton, William, J., and Murad, Jon. (2018) 'Precision Policing: Data, discretion, and community outreach can ensure a new era of public safety' *City Journal*, September https://www.city-journal.org/html/precision-policing-16033.html [accessed September 30, 2018]
[72] Ferguson, Andrew (2017) *The Rise of Big Data Policing: Surveillance, Race, and the Future of Law Enforcement*, New York University Press, New York, pp. 143-166.
[73] On the concept of 'Platform Capitalism' see Srnicek, Nick (2017) *Platform Capitalism*, Polity, Cambridge.